

Strategy to increase research in Latin America: project on education in research by AOSpine Latin America

Asdrubal Falavigna¹ · Délio Eulálio Martins Filho² · José María Jiménez Avila³ · Juan Pablo Guyot⁴ · Alvaro Silva Gonzáles⁵ · Daniel K. Riew⁶

Received: 2 April 2015 / Accepted: 11 May 2015
© Springer-Verlag France 2015

Abstract

Background The emancipatory nature of education requires research as its fundamental base, because physicians can only improve their skills and knowledge through enquiry. The number and quality of scientific publications by Latin-American spine surgeons found in the Medline database was low between 2000 and 2011. Nevertheless, the research Bank Survey of AOSpine Latin America (AOSLA) members showed that 96 % of responders were very interested and motivated to perform scientific research.

Methods and population The research officer of AOSLA together with the Country Council and the AOSpine Research Commission established a competency-based curriculum to improve understanding of what is necessary to produce research and the best methods to achieve this goal. The research curriculum was divided into four main components: (1) research educational plan, (2) performing research, (3) technical and professional support and (4) assessment.

Results The competences, learning outcomes and a syllabus on knowledge in research were developed to enable the participants to understand and perform investigations effectively. The eLearning module was designed to improve the competences to access, evaluate and use scientific information available in the main databases efficiently. Research courses were given as an isolated activity four times in Brazil and Mexico and as precourse activities six times in Brazil, Mexico and Peru. The result was an increased number of articles published and works presented at congresses.

Conclusions The project of education in research can be effectively disseminated and applied across regions, across students and across specialties.

Keywords Education · Research curriculum · Competency based · Publications

Introduction

Our goal as physicians is to prevent diseases and treat health problems, or at the very least reduce patients' suffering and improve their quality of life. A few conditions are necessary in order to successfully develop our work as physicians: having constant information and feedback regarding the effectiveness of our medical activity; being able to learn independently and have the correct tools to critically interpret scientific information; adopting the best treatment according to our own database; and not allowing autocratic entities or health policies dictate what is best for our patients. All these conditions necessary to perform those tasks can be developed by having knowledge in research. "Publishing results" are therefore only a consequence of an overall scientific investigative attitude.

✉ Asdrubal Falavigna
asdrubalmd@gmail.com

¹ Medical School, University of Caxias do Sul, Rua General Arcy da Rocha Nóbrega, 401/602, Caxias do Sul, RS, Brazil

² Medicine School Paulista, Federal University of São Paulo, São Paulo, Brazil

³ Centro Médico Nacional de Occidente, Guadalajara, Mexico

⁴ Hospital Universitario Fundación Favaloro, Buenos Aires, Argentina

⁵ Clínica Alemana - Universidad del Desarrollo, Santiago de Chile, Chile

⁶ Columbia University, New York City, NY, USA

The visibility of papers is achieved by publication in high-quality journals [1, 2]. The Institute of Scientific Information (ISI) and the Science Citation Index (SCI) are the instruments most frequently used by researchers and specialists to access bibliographic information and citations [3].

At the end of the 1990s, 14 Latin-American (LA) and Caribbean journals were registered at SCI and LA generated only 1.4 % of the 70,000 scientific papers produced worldwide [4]. Despite the small contribution of LA to SCI, there was an increase of 1–1.8 % in scientific publications in LA and in several countries between 1986 and 1991 [5–7]. These increases were below expectations, and the main reasons for this were culture, lack of economic resources and low qualification of the researchers [8].

Something had to be urgently done to change this scenario, such as promoting joint scientific activities to exchange experiences, identify and use the strengths of research centers, and maximize human resources. The purpose of this article is to describe the effectiveness of the project of education in research by AOSpine Latin America (AOSLA) in a region with minimal culture and knowledge of scientific investigation.

Methods and population

Before developing and implementing strategies to increase education in research, it was necessary to understand the causes as well the magnitude of the problem

and to know the centers or people that were performing research. The needs were identified by a literature search of publications by LA spinal surgeons using an online database and a research survey of the AOSLA members.

The Pubmed.gov publications by LA spine surgeons were analyzed from January 2000 to December 2011. The quality of the publication was measured by the journal impact factor [9, 10], Oxford classification [11] and number of citations. The AOSLA members' survey aimed at getting to know our membership: information about data on the demographic profile, level of interest, motivation and experience of doing research and creating a database on Latin-American researchers.

Research curriculum

The contents of research were delivered after information from the literature review and the survey was analyzed, and the specific needs of AOSLA members were defined. As the research officer of AOSLA, the first author spearheaded a team effort with the Country Council and the AOSpine Research Commission to enable and increase spine research output in Latin America. There was established a competency-based curriculum to improve understanding of what is necessary to produce research and the best methods to achieve this goal. The research curriculum was divided into four main components: (1) research educational plan, (2) performing research, (3) technical and professional support and (4) assessment (Table 1).

Table 1 Contents of the research curriculum

1. Research educational plan	1.1 Competences and learning outcomes in research 1.2 Theoretical resources 1.3 eLearning module 1.4 Research courses 1.5 Research lectures during the meeting
2. Performing research	2.1 Mentors/mentee research projects 2.2 Open calls research studies
3. Technical and professional support	3.1 Linguistic support 3.2 Statistical consultancy 3.3 Database 3.4 Research project reviewers
4. Assessment	4.1 Review of the publications by LA spinal surgeons on medicine 4.2 Research survey of the AOSLA members 4.3 Production of books, articles, intellectual property 4.4 Works presented at congress 4.5 Research network and collaborators 4.6 Greater insertion of students into research activities 4.7 Annual retention of students in research and participation in grants 4.8 Number of scientific initiation scholarships

1 Research educational plan

The concepts of research were provided by an organized and current didactic learning experience. In this section, all learning activities were defined and delivered.

1.1 Competences and learning outcomes in research

A competence is what a person must be able to do to understand and perform research. Consequently, it was initially necessary to establish the competence, learning outcomes, syllabus and lecture title of educational activities in research. The education and learning processes were guided and organized according to the competencies to be achieved.

1.2 Theoretical resources

It was necessary to have some content to read and introduce the basic concepts of research to all interested persons in a simple and didactic manner. The decision was to organize a book. Several participants were willing to contribute from different regions, such as LA, USA, Europe, Asia and the Middle East. Once the collaborators had been determined, virtual meetings or e-mail contacts were held to explain the objectives and learning outcomes of each chapter.

1.3 eLearning module

The course was developed as an online modality. Weekly, a class with practical activities was placed in the system to be carried out by the participants. Throughout this process, there was tutoring to answer questions and/or help in performing bibliographic surveys. The participants were assessed continuously while carrying out the tasks and participating in the forums.

1.4 Research courses

Specific courses on education in research were designed. The courses were delivered as 2-day courses or as a half-day or full-day course prior to another meeting.

1.5 Research lectures during the meeting

During the meeting, the research contents were delivered in two ways: (1) lectures presented within the program of the meeting with a link to the session, or (2) structured lecture presentations. An example of research lectures might be, in a session on new techniques, a lecture on "How to collect data and measure effectiveness". A structured lecture might be about evidence-based medicine on the surgical techniques or treatment that was being discussed, an

explanation of the technique used by the presenter to perform a literature review of the topic, or how the presenter recognized the positive and negative strengths of the papers used in the lecture, including what was missing in the publications.

2 Performing research

The only way to effectively measure and prove knowledge in research is to train to do research. Skills in research progressed by means of mentors/mentee projects, the creation of a research education center and by open calls.

2.1 Mentors/mentee research projects

The mentors/mentee process was created by the AOSpine Research Commission and performed in different regions: LA, Europe, the Middle East, Asia Pacific and North America. Each region selected one mentee who developed a scientific study along with the AO regional research officer under the supervision of the AO Research Chairperson.

In LA, several mentees, chosen for their willingness and aptitude to do research, were allowed to work with the LA research officer. The Cell Therapy Laboratory, as well as The Clinical Studies and Basic Models of Spinal Disorders Laboratory of the University of Caxias do Sul (UCS), has been the venues of several successful mentors/mentee programs in recent years.

2.2 Open calls research studies

Several open calls for multicenter studies were performed to publicize the research activities and to give everyone an opportunity to contribute and become involved in scientific studies.

3 Technical and professional support

The AOSLA office offered: (1) linguistic support, (2) statistical analysis, (3) database management and (4) research project reviewers to assist with the projects.

4 Assessment

A needs-assessment of education in research was performed after analyzing the publications by LA spinal surgeons on Medline and a research survey of the AOSLA members. The performance indicators to track the progress of the research program were established. These included tallying and grading the quality of research activities such as books, theses, dissertations, articles, intellectual property, works presented at congresses, research networks (partnerships, collaborators, interdisciplinary and multi-institutional research projects), involvement of students in

research activities, annual retention of students in research, annual participation in grants and the number of scientific initiation scholarships.

Results

Publications by LA spinal surgeons

The number and quality of scientific publications by LA spine surgeons found in the Medline database was low between 2000 and 2011 (Fig. 1) [12]. A total of 320 articles published were distributed among only seven LA countries: Brazil (64.4 %), Chile (18.8 %), Mexico (11.9 %), Argentina (2.5 %), Colombia (1.25 %), Ecuador (0.62 %) and Uruguay (0.62 %). In total, 45.3 % of publications were from the last 4 years. Clinical studies ($N = 121$; 37.8 %) were the most common type of articles. Publications in journals with an IF lower than 1.32 made up 46.6 % of the articles. Analysis of the Oxford classification demonstrated that most LA papers had a levels of evidence (LOE) 4 ($N = 171$, 53.4 %) and LOE 5 ($N = 56$, 17.5 %). 0.9 %). Linear-by-linear association analysis showed an improvement in the LOE of LA articles published in recent years (Linear-by-linear association: 12.955; $P = 0.0001$) [12].

Education in research survey

The research Bank Survey of AOSLA members showed that among the members interested in research, 71 % were

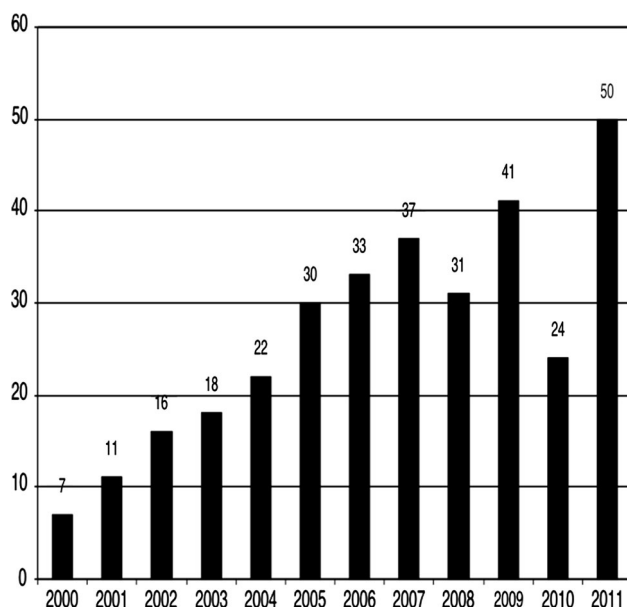


Fig. 1 Number of papers according to year of publication

30–50 years old, 88 % had less than 20 years of activity in spine surgery, the level of education was only specialized in 50 % of participants and only 13 % had a doctorate. They described the interest and motivation to do scientific research as very high and high in 67 % and medium in 29 %. The type of research of interest was clinical research in 87 %, usually in the field of degenerative spine in 75 % and spinal cord injury in 60 %. The main barrier to performing research despite the motivation and interest was lack of experience in doing research (74 %) mainly due to the scarcity of opportunities for research training (96 %).

Competences and learning outcomes in research

Once the needs have been identified, learning activities for research focus on establishing a competency-based curriculum to improve understanding of what is necessary to produce research and the best methods to achieve this goal. The competencies were a guiding framework for the design and delivery of all our learning activities. The competences developed were to: recognize the importance of performing a clinical research study, identify the basic tools necessary for research, assess and interpret evidence-based medicine, identify the basic contents of research, identify the basic needs for clinical research, recognize the methodology and problems with clinical research, learn how to get the paper published, assess the effectiveness of interventions and identify the research products available at AOSLA (Table 2).

Specific learning outcomes for each activity had to be defined according to the needs of the participants. Education in research competences, learning outcomes and a syllabus on knowledge in research are reported in Table 2. This learning strategy enables the participants to understand and perform investigations effectively.

eLearning module

The eLearning module was designed to improve the competences to access, evaluate and use scientific information available in the main databases efficiently. We had three virtual courses on research. All courses were fully subscribed. The feedback from the participants was very positive. After the course, the participants felt able and confident to seek and assess scientific evidence to assist and improve the quality of the decision-making process in health care.

Research courses

Research courses were given as an isolated activity four times in Brazil and Mexico and as precourse activities six times in Brazil, Mexico and Peru. This type of course was

Table 2 Competency, learning outcomes in research curriculum

Competence	Key learning outcomes	Lecture title	Lecture topics/syllabus outline
Recognize the importance of performing a clinical research study	Learn the elaboration process of clinical thinking	Improving clinical thinking through research	Organization of logical thinking and how it is improved through the presentation of clinically based problems
	Recognize the importance of organizing research groups	The importance of investigation tools in justifying our decisions	Skills acquired through research
	Identify changes in attitude by knowing research methodology concepts		The advantages brought by investigative tools that allow for reliable and valid feedback
Identify the basic tools necessary for research	Learn how and where to perform a literature search	How and where to search for an article	Principles of a literature search in medical databases
	Recognize the principles of common reference managers	How to work with reference managers	Main reference managers
Assess and interpret evidence-based medicine	Learn how to analyze a paper	Critical review of a scientific paper	Analyzing the contents of each part of an article
	Recognize basic statistical results and how to interpret them	Analyzing the contents of each part of an article	Revisiting general principles of biostatistics and the risk of bias
	Identify the quality of evidence in spine research	Evidence-based medicine: the good, the bad and the ugly	Reviewing the different types of study and their meaning
	Demonstrate the importance of evidence-based medicine (EBM) in clinical routine	The quality of studies: classification and the risk of bias	Critical evaluation of evidence vs. experience-based medicine: addressing distortions and misinterpretations, discussing the fact that both are complementary in clinical decision making and difference between efficacy and effectiveness
Identify the basic contents of research	Recognize the importance of having a good idea	How to transform the sought-for idea into a structured question?	Presenting the structured question as P.I.C.O and how to formulate a research question
	Identify the importance of ethics committees	Planning a research project	Showing the step-by-step process in a research project that allows the implementation of an idea: objectives, hypothesis, inclusion and exclusion criteria, methods, sample size, informed consent
	Address the different study designs in clinical research	The importance of ethics committees	
	Learn the scientific contents and principles of research projects	The content of free and informed consent	
Recognize the basic needs and routine of clinical research	Recognize the role of the sponsor or investigator site during the research	Structuring a clinical research center	Presenting the needs of a team (main investigator, sub-investigator and study coordinator)
	Select and qualify the research team at the investigation site	How to qualify the research team and their role	Showing the facilities (office, computer, interview room and place to store documents)
	Identify the steps to start clinical research	The clinical study: from beginning to end	Showing the step-by-step process of clinical studies
	Hospital facilities needed for clinical research	How to avoid, detect and correct complications in clinical studies	Presenting the importance of the relationship between the investigation site, the ethics committee and the sponsor
	Address the most common complications of clinical research		Presenting the most common problems encountered before and during a clinical study
Learn how to have your paper published	Recognize the basic structure and contents of the original article	Tips and tricks for writing an original paper	Learning the basic structure of an article and its contents
	Identify the bad practices of plagiarism and data fabrication	The bad practice of research: plagiarism and data fabrication	Presenting the consequences of bad research practices
	Learn how to choose the Journal in which to have your article published	How to select the Journal for publication	How to decide where to publish a paper

Table 2 continued

Competence	Key learning outcomes	Lecture title	Lecture topics/syllabus outline
Assess the effectiveness of interventions	<p>Identify the common instruments used to evaluate the outcomes and their peculiarities</p> <p>Address how to efficiently apply the outcome measures to the patient and how to ensure they are answered correctly</p> <p>Assess the importance of cost-utility research in order to maintain and apply effective medical treatment</p>	<p>How to measure outcomes following surgery</p> <p>How to implement patient self-report measures</p> <p>Importance and principles of cost-utility research</p>	<p>Instruments to evaluate patient satisfaction, pain and disability</p> <p>Influence of emotional aspects on surgical outcomes and how to measure them</p> <p>Main instruments to self-report on health-related quality of life: understanding the domains and components of SF36 and EuroQOL-5D</p> <p>Discussing the practical aspects of data collection in patient-based outcome</p> <p>Principles of cost-utility research and the step-by-step implementation of a cost-utility analysis</p>
Identify the research products available at AO	Recognize the research products and activities available AO that provide members with the initial tools needed to develop research	Which products does AO offer to make research easier?	Presenting research products (eLearning, research books, etc.) and research activities (symposia, mentoring and research projects) available at AO

also held at the Caxias do Sul University as an undergraduate course of the medical school and in other undergraduate courses in the field of health sciences, as well as at the postgraduate level. The last “AOne Research Meeting” was taught across the AO clinical divisions (AOSpine, AOTrauma, AOVET and AOCMF).

All of the feedback was very positive, and some testimonies were described below. The suggestions were incorporated into the educational content of subsequent courses to match the specific needs of the participants. For example, practical activities were increased such that later courses allocated the same amount of time for practical and theoretical activities.

“The AOSpine seminar discussed topics that are important to develop research on spine surgery in Brazil. The strong points of the event were the meeting and debate among people from the whole country, interested in scientific development in this field and the discussions during and after the good presentations by the faculty. I congratulate the Organizing Committee for this meeting and I am waiting to hear the date of the next one.” AC

“The event was very useful to me and I hope that it is possible to begin a Research Network.” JG

“I must compliment and, at the same time thank you for the excellent initiative of holding the Clinical Research Seminar. Besides an excellent atmosphere for interaction with others (as usual.) the topics discussed covered the entire range of the subject. I felt that all of the audience spoke the same language, and

I think that, like I did, they left the course feeling renewed and much improved as regards their capacity to produce scientific information.” JLS

“I thank you for your attention. And I should also mention here that the course was very useful for me. I felt more stimulated, not only to begin the project that I am already going to do, a graduate program strictu sensu, but also to develop other projects. I congratulate you all in the organization and, as usual, the AO experience of holding courses favors its excellence.” CR

Research lectures during general spine meetings

This educational activity was presented at least 18 times as research lectures inserted into the program and 35 times as structured research lectures.

Performing research

We tracked the progress of the activity by the increased number of publications among the researchers in LA and the increasing number of people willing to do research. The positive effects of mentor/mentee activities and the research education center made it possible for the participant to learn while doing. The result was an increased number of articles published, research centers, works presented at congresses, development of intellectual property, growing involvement of students in research activities and international or national collaboration in studies and publications.

Technical and professional support

The support of the AOSLA office was crucial to the success of the project by providing linguistic support, statistical analysis, creation of databases and implementation of a group of evaluators to review the scientific methodology and to act as advisors for the projects. This allowed the research project to apply for competitive grants.

Discussion

Many factors are involved in the low research productivity of LA spine surgeons, such as (1) the predominance of an oral culture, (2) unfamiliarity with the English language and other types of biases (bias toward nationality) that can influence the approval rate [13, 14], (3) belief in the lack of interest among researchers from central countries toward research done in the periphery, (4) the ephemeral life of local journals, (5) lack of funds and (6) lack of trained personnel [8].

The fact that only 320 articles were published in the Medline database by LA spine surgeons from 2000 to 2011 shows that these countries are not fully engaged in research activities. Fortunately, many AOSLA members are motivated and interested in learning about research. We believe that to increase research output by LA spine surgeons, we first must improve the education process for research. We found that research education is relatively inexpensive and highly effective. We not only taught the methodology for publishing a paper, but also how to do research in our daily practice.

Although research may initially appear to be an optional activity, future directions in healthcare policies as well as our own edification necessitate an analysis of the effectiveness or non-effectiveness of our treatment. This is only possible if the physician has the research tools to permit them to recognize where and how they can best obtain reliable information, perform a critical literature review, choose validated instruments to measure the patient's disease, obtain reliable feedback regarding the effectiveness of our surgical activity and achieve a better understanding of the positive influence of research on the medical routine.

It is never too soon or too late to learn how to do research. The goals of the present project on education in research were to utilize available human resources; to identify and stimulate possible research groups to form a research network; to allow the integration and exchange of experiences to enable partnerships; to improve the quality and increase the quantity of scientific publications; and to initiate competitive studies to apply for funds from development agencies and governmental and non-governmental entities. The main idea was not to give money for research

but instead to help the researchers to obtain money by producing better projects to apply for available grants.

The most appropriate learning methods used to deliver relevant educational content included reading books on research, face-to-face educational courses, lectures and virtual learning courses and practical activities. The authors are convinced that active involvement in education in research curricula will ultimately translate into better quality care for the patients.

AOSLA aims to reach people with education in research from medical school to advanced courses in the specialty. The goal is to challenge current paradigms, provoke thought and open the mind to new ideas and skills. It is wrong to think that research should only be done in MSc and doctorate programs. In medical school, research is fundamental to the scientific principle, as well as the basis for nearly all of the educational content. From the moment physicians complete their formal medical education, they are directly responsible for their own continued learning, which will last throughout their lifetime of practice. Continuous learning has become a necessity for all professionals, and research tools are essential to make this happen.

Physicians can only improve their skills and knowledge through enquiry. Between education and research, there is a coinciding path: both take a position against ignorance; both value enquiry; both dedicate themselves to the reconstructive process; both include the confluence between theory and practice; both oppose the condition of being static; both oppose manipulation of truths; and both oppose plagiarism. This high-performance product "Project of Education in Research" responds to an unfulfilled need and can be applied "across clinical divisions, across regions, across students and specialties".

Conclusion

The emancipatory nature of education requires research as its fundamental base. This project of education in research can be effectively disseminated and applied across regions, across students and across specialties. It is part of the circle of life: "You see one, you do one, you teach one". It is a high-performance product to fill a gap of necessity.

Conflict of interest None.

References

1. Andalia RC (1999) Los análisis de citas en la evaluación de los trabajos científicos. *Acimed* 7:30–39
2. Henríquez HO (2004) Visibilidad: El reto de las Revistas Científicas Latinoamericanas - *Revista de Ciencias Humanas y Sociales* 20:131–138

3. Macias-Chapula CA (1998) O papel da informetria e da cienciometria e sua perspectiva nacional e internacional. *Ci Inf* 27:134–140
4. Angón MBMAP (1999) *Revistas Mexicanas de Investigación Tecnológica - Interciencia* 24:102–106
5. Hedlwein FL, Hartmann AA, Kalil AN et al (2010) Cited Brazilian papers in general surgery between 1970 and 2009. *Clinics* 65:521–529
6. Tess BH, Furuie SS, Castro RC et al (2009) Assessing the scientific research productivity of a Brazilian healthcare institution: a case study at the Heart Institute of Sao Paulo, Brazil. *Clinics* 64:571–576
7. Weisinger JR, Bellorin-Font E (1999) Latin American nephrology: scientific production and impact of the publications. *Kidney Int* 56:1584–1590
8. Escobar SCP, Costa MCD (2006) Visibility of latin american scientific publications: the example of Bolivia. *J Sci Commun* 5:1–8
9. Restivo FM, Tassi F, Biffi R et al (1995) Linkage arrangement of RFLP loci in progenies from crosses between doubled haploid *Asparagus officinalis* L. clones. *TAG Theor Appl Genet* 90:124–128
10. Reuters T (2012) *Journal of Citations Reports* (cited 2012 May 19). http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports
11. CEBM (2012) Oxford Center for evidence-based medicine (cited 2012 April 11). <http://www.cebm.net>
12. Falavigna A, Botelho RV, Teles AR et al (2014) Twelve years of scientific production on Medline by Latin American spine surgeons. *Plos One* 9:e87945
13. Thakur A, Wang EC, Chiu TT et al (2001) Methodology standards associated with quality reporting in clinical studies in pediatric surgery journals. *J Pediatr Surg* 36:1160–1164
14. Horton R (1996) Surgical research or comic opera: questions, but few answers. *Lancet* 347:984–985